WE CLAIM:

1. A parallel flow reaction system for effecting four or more simultaneous reactions in four or more reaction channels, the reaction system comprising

four or more reactors, each of the four or more reactors comprising a surface defining a reaction cavity for carrying out a chemical reaction, an inlet port in fluid communication with the reaction cavity, and an outlet port in fluid communication with the reaction cavity, and

a fluid distribution system for simultaneously supplying a feed composition comprising at least two feed components in varying relative amounts to the reaction cavity of each of the four or more reactors, and for discharging a reactor effluent from the outlet port of each such reaction cavity to one or more effluent sinks, the fluid distribution system comprising a feed-composition subsystem that comprises

four or more mixing zones, each of the four or more mixing zones being in fluid communication with one of the four or more reactors,

a first feed component source in fluid communication with each of the four or more mixing zones,

a set of four or more first-feed-component flow restrictors, each of the four or more first-feed-component flow restrictors providing fluid communication between the first feed component source and one of the four or more mixing zones, each of the four or more first-feed-component flow restrictors having a flow resistance that varies relative to other first-feed-component flow restrictors in the set, and

a second feed component source in fluid communication with each of the four or more mixing zones.

2. The reaction system of claim 1 wherein the feed-composition subsystem further comprises a set of four or more second-feed-component flow restrictors, each of the four or more second-feed-component flow restrictors providing fluid communication between the second feed component source and one of the four or more mixing zones.

3. The reaction system of claim 2 wherein each of the four or more second-feed-component flow restrictors has a flow resistance that varies relative to other second-feed-component flow restrictors in the set.

4. The reaction system of claim 2 wherein each of the four or more second-feed-component flow restrictors has a flow resistance that is substantially the same as other second-feed-component flow restrictors in the set.

5. The reaction system of claim 2 wherein the feed-composition subsystem further comprises

a third feed component source in fluid communication with each of the four or more mixing zones, and

a set of four or more third-feed-component flow restrictors, each of the four or more third-feed-component flow restrictors providing fluid communication between the third feed component source and one of the four or more mixing zones.

6. The reaction system of claim 5 wherein each of the four or more third-feed-component flow restrictors have a flow resistance that varies relative to other third-feed-component flow restrictors in the set.

7. The reaction system of claim 5 wherein

each of the four or more second-feed-component flow restrictors has a flow resistance that varies relative to other second-feed-component flow restrictors in the set, and

each of the four or more third-feed-component flow restrictors have a flow resistance that is substantially the same as other third-feed-component flow restrictors in the set.

8. The reaction system of claim 2 wherein the four or more first-feed-component flow restrictors and the four or more second-feed-component flow restrictors have flow resistances effective for providing varied relative amounts of the first and second

components between each of the four or more mixing zones while maintaining substantially the same total flow through each of the four or more mixing zones.

9. The reaction system of claim 1 wherein the reaction cavity has a volume of not more than about 100 ml.

10. The reaction system of claim 1 wherein each of the four or more first-feed-component flow restrictors are integral with a substrate or with one or more microchip bodies mounted on a substrate.

11. The reaction system of claim 1 wherein each of the four or more first-feed-component flow restrictors are integral with a substrate.

12. The reaction system of claim 1 wherein each of the four or more first-feed-component flow restrictors are integral with one or more microchip bodies mounted on a substrate.

13. The reaction system of claim 1 wherein each of the four or more first-feed-component flow restrictors are integral with one or more microchip bodies detachably mounted on a substrate.

14. The reaction system of claim 1 wherein each of the four or more first-feed-component flow restrictors are microfluidic channels.

15. The reaction system of claim 1 wherein each of the four or more first-feed-component flow restrictors are capillaries.

16. The reaction system of claim 1 wherein the feed composition subsystem comprises

a first plurality of selectable dedicated first-feed-component flow restrictors having different flow resistances, and providing selectable fluid communication between the first feed component source and a first mixing zone of the four or more mixing zones,

a second plurality of selectable dedicated first-feed-component flow restrictors having different flow resistances, and providing selectable fluid communication between the first feed component source and a second mixing zone of the four or more mixing zones,

a third plurality of selectable dedicated first-feed-component flow restrictors having different flow resistances, and providing selectable fluid communication between the first feed component source and a third mixing zone of the four or more mixing zones,

a fourth plurality of selectable dedicated first-feed-component flow restrictors having different flow resistances, and providing selectable fluid communication between the first feed component source and a fourth mixing zone of the four or more mixing zones,

such that the set of four or more first-feed-component flow restrictors can be selected to include at least one flow restrictor from each of the first plurality, the second plurality, the third plurality and the fourth plurality of selectable, dedicated first-feed-component flow restrictors.

17. The reaction system of claim 2 wherein the feed composition subsystem comprises

a first plurality of selectable dedicated groups of feed-component flow restrictors, each of the selectable dedicated groups of the first plurality comprising a first-feed-component flow restrictor and a second-feed-component flow restrictor, the first feed-component-flow restrictor providing fluid communication between the first feed component source and a first mixing zone of the four or more mixing zones, the second-

feed-component flow restrictor providing fluid communication between the second feed component source and the first mixing zone, the flow resistance of at least the first-feed-component flow restrictor varying between the selectable groups of the first plurality,

a second plurality of selectable dedicated groups of feed-component flow restrictors, each of the selectable dedicated groups of the second plurality comprising a first-feed-component flow restrictor and a second-feed-component flow restrictor, the first feed-component-flow restrictor providing fluid communication between the first feed component source and a second mixing zone of the four or more mixing zones, the second-feed-component flow restrictor providing fluid communication between the second feed component source and the second mixing zone, the flow resistance of at least the first-feed-component flow restrictor varying between the selectable groups of the second plurality,

a third plurality of selectable dedicated groups of feed-component flow restrictors, each of the selectable dedicated groups of the third plurality comprising a first-feed-component flow restrictor and a second-feed-component flow restrictor, the first feed-component-flow restrictor providing fluid communication between the first feed component source and a third mixing zone of the four or more mixing zones, the second-feed-component flow restrictor providing fluid communication between the second feed component source and the third mixing zone, the flow resistance of at least the first-feed-component flow restrictor varying between the selectable groups of the third plurality, and

a fourth plurality of selectable dedicated groups of feed-component flow restrictors, each of the selectable dedicated groups of the fourth plurality comprising a first-feed-component flow restrictor and a second-feed-component flow restrictor, the first feed-component-flow restrictor providing fluid communication between the first feed component source and a fourth mixing zone of the four or more mixing zones, the second-feed-component flow restrictor providing fluid communication between the second feed component source and the fourth mixing zone, the flow resistance of at least the first-feed-component flow restrictor varying between the selectable groups of the fourth plurality,

such that the set of four or more first-feed-component flow restrictors and the set of four or more second-feed-component flow restrictors can be selected to include at least one group of flow restrictors from each of the first plurality, the second plurality, the third plurality and the fourth plurality of selectable, dedicated groups of feed-component flow restrictors.

18. The reaction system of claim 17 wherein each of the four or more second-feed-component flow restrictors has a flow resistance that varies relative to other second-feed-component flow restrictors in the set, and the flow resistance of the second-feed-component flow restrictor varies between the selectable groups of each of the first plurality, the second plurality, the third plurality and the fourth plurality of selectable dedicated groups of feed-component flow restrictors.

19. The reaction system of claims 17 or 18 wherein each of the first plurality, the second plurality, the third plurality and the fourth plurality of selectable dedicated groups of feed-component flow restrictors further comprises a third-feed-component flow restrictor, the third feed-component-flow restrictor providing fluid communication between the third feed component source and the first mixing zone, the second mixing zone, the third mixing zone and the fourth mixing zone, respectively.

20. The reaction system of claim 19 wherein the flow resistance of the third-feed-component flow restrictor is substantially the same between the selectable groups of each of the first plurality, the second plurality, the third plurality and the fourth plurality of selectable dedicated groups of feed-component flow restrictors.

21. The reaction system of claim 16 wherein the feed-composition subsystem further comprises four or more first-feed-component selection valves for selecting at least one first-feed-component flow restrictor from each of the first plurality, the second plurality, the third plurality and the fourth plurality of selectable dedicated first-feed-

component flow restrictors to form the first set of four or more first-feed-component flow restrictors.

22. The reaction system of claim 16 wherein the feed-composition subsystem further comprises a first plurality of first-feed-component isolation valves for selecting at least one flow restrictor from the first plurality of selectable dedicated first-feed-component flow restrictors, a second plurality of first-feed-component isolation valves for selecting at least one flow restrictor from the second plurality of selectable dedicated first-feed-component flow restrictors, a third plurality of first-feed-component isolation valves for selecting at least one flow restrictor from the third plurality of selectable dedicated first-feed-component flow restrictors, and a fourth plurality of first-feed-component isolation valves for selecting at least one flow restrictor from the fourth plurality of selectable dedicated first-feed-component flow restrictors.

23. The reaction system of claim 17 wherein the feed-composition subsystem further comprises a

a first plurality of commonly-actuated first groups of feed-component isolation valves for selecting at least one group of feed-component flow restrictors from the first plurality of selectable dedicated groups of feed-component flow restrictors, each of the first groups of feed-component isolation valves comprising a first-feed-component isolation valve and a second-feed-component isolation valve adapted for common actuation,

a second plurality of commonly-actuated second groups of feed-component isolation valves for selecting at least one group of feed-component flow restrictors from the second plurality of selectable dedicated groups of feed-component flow restrictors, each of the second groups of feed-component isolation valves comprising a first-feed-component isolation valve and a second-feed-component isolation valve adapted for common actuation,

a third plurality of commonly-actuated third groups of feed-component isolation valves for selecting at least one group of feed-component flow restrictors from the third plurality of selectable dedicated groups of feed-component flow restrictors, each of the

third groups of feed-component isolation valves comprising a first-feed-component isolation valve and a second-feed-component isolation valve adapted for common actuation, and

a fourth plurality of commonly-actuated fourth groups of feed-component isolation valves for selecting at least one group of feed-component flow restrictors from the fourth plurality of selectable dedicated groups of feed-component flow restrictors, each of the fourth groups of feed-component isolation valves comprising a first-feed-component isolation valve and a second-feed-component isolation valve adapted for common actuation.

24. The reaction system of claims 22 or 23 wherein the feed-component isolation valves are integral with a substrate or with one or more microchip bodies mounted on a substrate.

25. The reaction system of claims 22 or 23 wherein the first-feed-component flow restrictors and the second-feed-component flow restrictors are integral with a substrate or with one or more microchip bodies mounted on a substrate.

26. The reaction system of claims 22 or 23 wherein the feed-component isolation valves are integral with a substrate or with one or more microchip bodies mounted on a substrate, and the first-feed-component flow restrictors and the second-feed-component flow restrictors are integral with a substrate or with one or more microchip bodies mounted on a substrate.

27. The reaction system of claim 1 wherein the feed-composition subsystem comprises a series of selectable sets of first-feed-component flow restrictors, the series comprising

a first set of four or more first-feed-component flow restrictors comprising first, second, third and fourth first-feed-component flow restrictors providing fluid communication between the first feed component source and a first, second, third and

fourth mixing zone of the four or more mixing zones, respectively, each of the first, second, third and fourth first-feed-component flow restrictors of the first set having a different flow resistance relative to each other, and

a second set of four or more first-feed-component flow restrictors comprising first, second, third and fourth first-feed-component flow restrictors providing fluid communication between the first feed component source and the first, second, third and fourth mixing zones, respectively, each of the first, second, third and fourth first-feed-component flow restrictors of the second set having a different flow resistance relative to each other, the flow resistance of at least one of the four or more first-feed-component flow restrictors of the second set varying from the flow resistance of the corresponding first-feed-component flow restrictor of the first set,

such that the first set or the second set of first-feed-component flow restrictors can be selected to provide fluid communication between the first feed component source and the four or more mixing zones.

28. The reaction system of claim 2 wherein the feed-composition subsystem comprises a series of selectable sets of feed-component-flow-restrictor groups, the series comprising

a first set of four or more groups of feed-component flow restrictors, the four or more groups of the first set comprising a first group of feed-component flow restrictors in fluid communication with a first mixing zone, a second group of feed-component flow restrictors in fluid communication with a second mixing zone, a third group of feed-component flow restrictors in fluid communication with a third mixing zone, and a fourth group of feed-component flow restrictors in fluid communication with a fourth mixing zone, each of the groups of feed-component flow restrictors comprising a first-feed-component flow restrictor in fluid communication with the first feed component source, and a second-feed-component flow restrictor in fluid communication with the second feed component source, the flow resistance of at least the first-feed-component flow restrictor varying between the four or more groups of the first set, and

a second set of four or more groups of feed-component flow restrictors, the four or more groups of the second set comprising a first group of feed-component flow restrictors in fluid communication with a first mixing zone, a second group of feed-component flow restrictors in fluid communication with a second mixing zone, a third group of feed-component flow restrictors in fluid communication with a third mixing zone, and a fourth group of feed-component flow restrictors in fluid communication with a fourth mixing zone, each of the groups of feed-component flow restrictors comprising a first-feed-component flow restrictor in fluid communication with the first feed component source, and a second-feed-component flow restrictor in fluid communication with the second feed component source, the flow resistance of at least the first-feed-component flow restrictor varying between the four or more groups of the second set,

such that the first set or the second set of feed-component-flow-restrictor groups can be selected to provide fluid communication between the first and second feed component sources and each of the four or more mixing zones.

29. The reaction system of claim 28 wherein

each of the four or more second-feed-component flow restrictors in the first and second sets of feed-component-flow-restrictor groups has a flow resistance that varies relative to other second-feed-component flow restrictors in the first and second sets, respectively, and

the flow resistance of the second-feed-component flow restrictors varies between at least one of the groups of the first set and the corresponding one of the groups of the second set.

30. The reaction system of claims 28 or 29 wherein each of the first group, the second group, the third group and the fourth group of the first and second sets of feed-component-flow-restrictor groups further comprises a third-feed-component flow restrictor, the third feed-component-flow restrictor providing fluid communication between a third feed component source and the first mixing zone, the second mixing zone, the third mixing zone and the fourth mixing zone, respectively.

31. The reaction system of claims 28 or 29 wherein the feed-composition subsystem further comprises a set of four or more third-feed-component flow restrictors, each of the third feed-component-flow restrictors providing fluid communication between a third feed component source and one of the four or more mixing zones.

32. The reaction system of claim 31 wherein the flow resistance of the third-feed-component flow restrictors is substantially the same as other third-feed-component flow restrictors in the set.

33. The reaction system of claim 27 wherein the feed-composition subsystem further comprises a first-feed-component selection valve for selecting at least one of the first or second sets of first-feed-component flow restrictors.

34. The reaction system of claim 28 wherein the feed-composition subsystem further comprises a first-feed-component selection valve for selecting at least one of the first or second sets of feed-component-flow-restrictor groups.

35. The reaction system of claim 27 wherein the feed-composition subsystem further comprises a series of first-feed-component isolation valves, the isolation valve series comprising first and second first-feed-component isolation valves for selecting at least one of the first or second sets of first-feed-component flow restrictors.

36. The reaction system of claim 28 wherein the feed-composition subsystem further comprises

a first group of feed-component isolation valves for selecting the first set of feed-component-flow-restrictor groups, the first group of feed-component isolation valves comprising a first-feed-component isolation valve and a second-feed-component isolation valve adapted for common actuation, and

a second group of feed-component isolation valves for selecting the second set of feed-component-flow-restrictor groups, the second group of feed-component isolation

valves comprising a first-feed-component isolation valve and a second-feed-component isolation valve adapted for common actuation.

37. The reaction system of claims 27 or 28 wherein the feed-component isolation valves are integral with a substrate or with one or more microchip bodies mounted on a substrate.

38. The reaction system of claims 27 or 28 wherein the first-feed-component flow restrictors and the second-feed-component flow restrictors are integral with a substrate or with one or more microchip bodies mounted on a substrate.

39. The reaction system of claims 27 or 28 wherein the feed-component isolation valves are integral with a substrate or with one or more microchip bodies mounted on a substrate, and the first-feed-component flow restrictors and the second-feed-component flow restrictors are integral with a substrate or with one or more microchip bodies mounted on a substrate.

40. The reaction system of claims 1, 16, 17, 27 or 28 wherein the fluid distribution system further comprises one or more subsystems selected from the group consisting of (a) a flow-partitioning subsystem for providing a different flow rate to each of the four or more reactors, (b) a pressure-partitioning subsystem for providing a different reaction pressure in the reaction cavity of each of the four or more reactors, and (c) a temperature-control subsystem for providing a different reaction temperature in the reaction cavity of each of the four or more reactors.

41. The reaction system of claim 40 wherein the fluid distribution system further comprises the flow-partitioning subsystem, the flow-partitioning subsystem including at least one set of four or more flow restrictors, each of the four or more flow restrictors of the flow-partitioning system having a flow resistance that varies relative to other flow restrictors in the set.

42. The reaction system of claim 40 wherein the fluid distribution system further comprises the pressure-partitioning subsystem, the pressure-partitioning subsystem including at least one set of four or more flow restrictors, each of the four or more flow restrictors of the pressure-partitioning system having a flow resistance that varies relative to other flow restrictors in the set.

43. The reaction system of claim 40 wherein the fluid distribution system further comprises the temperature control system.

44. The reaction system of claim 40 further comprising a detection system for detecting at least one reaction product or unreacted reactant from the effluent discharged from each of the four or more reactors.

45. The reaction system of claim 1 further comprising a detection system for detecting at least one reaction product or unreacted reactant from the effluent discharged from each of the four or more reactors.

46. The reaction system of claim 1 further comprising a parallel detection system for simultaneously detecting at least one reaction product or unreacted reactant from the effluent discharged from each of the four or more reactors.

47. The reaction system of claim 1 further comprising a parallel gas chromatograph for simultaneously detecting at least one reaction product or unreacted reactant from the effluent discharged from each of the four or more reactors.

48. The reaction system of claim 1 wherein the reaction cavity of each of the four or more reactors has a volume of not more than about 10 ml.

49. The reaction system of claim 1 wherein the reactors and fluid distribution system are adapted to effect a chemical reaction of interest at a temperature of not less

than about 100 °C and additionally, or alternatively, at a pressure of not less than about 10 bar.

50. A method for evaluating a chemical reaction process, the method comprising

feeding a first feed component from a first feed component source to four or more mixing zones, each of the four or more mixing zones being in fluid communication with one of four or more reactors, the first feed component being fed through a set of four or more first-feed-component flow restrictors, each of the four or more first-feed-component flow restrictors providing fluid communication between the first feed component source and one of the four or more mixing zones, each of the four or more first-feed-component flow restrictors having a flow resistance that varies relative to other first-feed-component flow restrictors in the set, and

feeding a second feed component from a second feed component source to the four or more mixing zones to form four or more feed compositions having varying relative amounts of the first and second feed components,

simultaneously supplying the four or more varying feed compositions to the four or more reactors,

controlling the reaction conditions in each of the four or more reaction cavities to effect a chemical reaction of interest, and

discharging a reactor effluent from each of the four or more microreactors.

51. The method of claim 50 further comprising controlling a set of reaction conditions comprising temperature, pressure and flow rate to be substantially the same in each of the four or more reactors.

52. The method of claim 50 further comprising controllably varying one or more reaction conditions between the four or more reactors, the one or more varied reaction conditions being selected from the group consisting of temperature, pressure and flow rate.

53. The method of claim 50 further comprising detecting a reaction product or an unreacted reactant in the reactor effluent discharged from each of the four or more reactors.

54. The method of claims 53 wherein the reaction product or the unreacted reactant from each of the four or more reactors are simultaneously detected.

55. The method of claims 53 wherein the reaction product or the unreacted reactant from each of the four or more reactors are simultaneously detected using gas chromatography or mass spectrometry.

56. The method of claims 53 wherein the reaction product or the unreacted reactant from each of the four or more reactors are simultaneously detected using gas chromatography.

57. The method of claim 50 wherein the steps of feeding the first component, feeding the second component, supplying the four or more varying feed compositions, controlling the reaction conditions, and discharging the reactor effluent are effected in the chemical reaction system of claims 1, 16, 17, 27 or 28.

58. A reaction system for effecting a chemical reaction, the reaction system comprising

one or more reactors, each of one or more reactors comprising a surface defining a reaction cavity for carrying out a chemical reaction, an inlet port in fluid communication with the reaction cavity, and optionally, an outlet port in fluid communication with the reaction cavity, and

a fluid distribution system for selectively supplying a plurality of different feed compositions to the one or more reactors, each of the plurality of different feed compositions comprising at least two feed components in varying relative amounts, and optionally, for discharging a reactor effluent from the optional outlet port of the one or

more reactors to one or more effluent sinks, the fluid distribution system comprising a feed-composition subsystem that comprises

two or more mixing zones, each of the two or more mixing zones being in selectable fluid communication with the one or more reactors,

a first feed component source in fluid communication with each of the two or more mixing zones,

a set of two or more first-feed-component flow restrictors, each of the two or more first-feed-component flow restrictors providing fluid communication between the first feed component source and one of the two or more mixing zones, each of the two or more first-feed-component flow restrictors having a flow resistance that varies relative to other first-feed-component flow restrictors in the set, and

a second feed component source in fluid communication with each of the two or more mixing zones.

59. The reaction system of claim 58 wherein each of the two or more first-feed-component flow restrictors are integral with a substrate or with one or more microchip bodies mounted on a substrate.

60. A fluid distribution system for simultaneously forming four or more fluid compositions comprising at least two or more components in varying relative amounts, the fluid distribution system comprising

four or more mixing zones for forming the four or more fluid compositions,

a first feed component source in fluid communication with each of the four or more mixing zones,

a set of four or more first-feed-component flow restrictors, each of the four or more first-feed-component flow restrictors providing fluid communication between the first feed component source and one of the four or more mixing zones, each of the four or more first-feed-component flow restrictors having a flow resistance that varies relative to other first-feed-component flow restrictors in the set, and

a second feed component source in fluid communication with each of the four or more mixing zones.

61. The reaction system of claim 60 wherein the fluid distribution further comprises a set of four or more second-feed-component flow restrictors, each of the four or more second-feed-component flow restrictors providing fluid communication between the second feed component source and one of the four or more mixing zones.

62. The reaction system of claim 61 wherein each of the four or more second-feed-component flow restrictors has a flow resistance that varies relative to other second-feed-component flow restrictors in the set.

63. The reaction system of claim 61 wherein each of the four or more second-feed-component flow restrictors has a flow resistance that is substantially the same as other second-feed-component flow restrictors in the set.

64. The reaction system of claim 61 wherein the fluid distribution system further comprises

a third feed component source in fluid communication with each of the four or more mixing zones, and

a set of four or more third-feed-component flow restrictors, each of the four or more third-feed-component flow restrictors providing fluid communication between the third feed component source and one of the four or more mixing zones.

65. The reaction system of claim 64 wherein each of the four or more third-feed-component flow restrictors have a flow resistance that varies relative to other third-feed-component flow restrictors in the set.

66. The reaction system of claim 64 wherein

each of the four or more second-feed-component flow restrictors has a flow resistance that varies relative to other second-feed-component flow restrictors in the set, and

each of the four or more third-feed-component flow restrictors have a flow resistance that is substantially the same as other third-feed-component flow restrictors in the set.

67. The fluid distribution system of claim 60 wherein each of the four or more mixing zones comprises a flow cavity having at least one outlet for discharging the fluid composition formed therein.

68. The fluid distribution system of claim 60 wherein each of the four or more mixing zones comprises a batch cavity.

69. The fluid distribution system of claim 60 wherein each of the four or more mixing zones is a flow or batch reaction cavity.

70. The fluid distribution system of claim 60 wherein each of the four or more mixing zones is a well of a parallel batch reactor.

71. The fluid distribution system of claim 60 wherein each of the four or more mixing zones is a processing chamber adapted for non-reactive processing of the four or more fluid compositions.

72. The fluid distribution system of claim 60 wherein each of the four or more mixing zones is a well of a microtiter plate.

73. The fluid distribution system of claim 60 wherein the four or more first-feed-component flow restrictors are integral with a substrate or with one or more microchip bodies mounted on a substrate.

74. The fluid distribution system of claim 60 wherein the four or more first-feed-component flow restrictors are integral with one or more microchip bodies detachably mounted on a substrate.

75. The fluid distribution system of claim 60 wherein the cavity is a flow cavity and comprises the outlet in fluid communication with the at least one effluent sink.

76. The fluid distribution system of claim 60 wherein the cavity has a volume of not more than about 100 ml.